



# DECLARATION OF TRANSLATION

I, Atsushi Inoue of ARKMori Building, 13F, 12-32, Akasaka 1-chome, Minato-ku, Tokyo 107-6013, Japan, do hereby certify that I am conversant with the English and Japanese languages and am a competent translator thereof, and I further certify that to the best of my knowledge and belief the following is a true and correct translation made by me of U.S. Patent Application No. 10/691,338 filed in a language other than English.

Signed this 24th day of August, 2004

  
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Atsushi Inoue



## LIQUID CARTRIDGE

### BACKGROUND OF THE INVENTION

#### 1. Field of the Invention

The present invention relates to a liquid cartridge  
5 storing liquid such as ink therein and supplies the liquid  
to a liquid ejection apparatus. Particularly, the  
invention relates to an ink cartridge suitable for an  
ink jet recording apparatus, and more specifically to  
an ink cartridge which transmits data on ink stored in  
10 a container to a recording apparatus side by radio  
communication.

#### 2. Description of the Related Art

As disclosed in JP-A-2002-1991 (corresponding to  
US Patent Application No. US2002/0030710A1), an ink  
15 cartridge which transmits data on ink stored therein to  
a recording apparatus by radio communication has been  
proposed.

On the other hand, in a recording apparatus in which  
an ink cartridge is removably mounted on a carriage  
20 including a recording head, the ink cartridge  
reciprocates during a recording operation, while it  
receives limitation of radio output from a viewpoint of  
electromagnetic radiation. Therefore, for such the ink  
cartridge, to secure the sure communication is a  
25 practically large problem.

In order to solve such the problem, in U.S.P No. 6302527, an ink cartridge has been disclosed, which receives radio electric power irradiated from a recording apparatus, converts the radio electric power into working electric power to operate a liquid amount sensor and a memory, and converts the data of the liquid amount sensor and the memory into radio signals thereby to transmit the radio signals to the recording apparatus by a link unit. However, its specific structure is not clear.

10

#### SUMMARY OF THE INVENTION

In view of such the problem, it is an object of invention to provide a liquid cartridge which can perform sure communication by radio output as small as possible.

In order to solve such the problem, according to the invention, in a liquid cartridge including a container having a liquid supply port connectable to a flowing path communicating with a liquid ejection head, a memory storing therein data on liquid housed in the container, and a communication unit which communicates the data in the memory to a recording apparatus by radio, the communication unit is provided on a wall opposed to a wall in which the liquid supply port is formed, and includes an antenna portion in which at least a rectangular conductive pattern is formed.

25        Hereby, since the antenna portion is exposed from

an opening portion of a carriage, regardless of material constituting the carriage, sure communication can be performed by radio output as small as possible.

Further, in the invention, the container comprises  
5 a bottomed-box type container having the liquid supply port, and a lid member sealing an opening portion of the container body; and the antenna portion is provided so as to occupy at least 70% of one wall surface region of the container body.

10 Hereby, on the flat wall surface of the container body, the antenna portion having capacity necessary and enough for communication with the recording apparatus can be formed.

Further, the antenna portion may be so constituted  
15 that a conductive pattern constituting an antenna is formed on a base body. Further, the antenna portion may be so constituted that a conductive pattern constituting an antenna is formed on a base body, and the memory is mounted on the antenna portion. Furthermore, the  
20 antenna portion may be so constituted that a conductive pattern constituting an antenna is formed on a base body, and the memory and a detecting unit detecting an amount of the liquid are mounted on the antenna portion.

Thus, by forming an adhesive layer on the base body,  
25 the antenna portion can be readily fixed onto the liquid

cartridge, and the memory and the detection unit detecting an amount of liquid can be mounted on the liquid cartridge.

5 In the invention, an expansion part is formed at one end of the base body, and the detecting unit is mounted on the expansion part.

Thus, by bending the base body, the detecting unit can be bonded onto a surface of the base body other than the surface on which the antenna portion is provided.

10 In the invention, the container is formed so that its width is different according to the kind of the liquid, and the antenna portion of the same specification is provided on the wall surface of the container which becomes an upper surface in a state where the cartridge is attached.

15 Hereby, the antenna portion of the same specification can be applied to the container different in the amount of liquid.

In the invention, a recess is formed in a region where the antenna portion is arranged, and the antenna portion is housed in the recess.

Hereby, it is possible to prevent break of the antenna portion due to a rub with another member caused in transportation of products.

25 In the invention, the recess is formed so that its

depth is larger than a thickness of the antenna portion.

Hereby, even if the recess is sealed with a protective cover such as an adhesive tape, the adhesive is not attached onto the antenna portion and recycle of  
5 the antenna portion is facilitated.

In the invention, a protective cover material is stuck onto at least an upper surface of the antenna portion.

Hereby, it is possible to prevent break of the  
10 antenna portion due to a rub with another member caused in transportation of products.

In the invention, a lever for supporting an attachment operation is provided for the cartridge.

Hereby, it is possible to prevent the antenna  
15 portion from being touched as much as possible when the cartridge is attached.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a diagram showing one embodiment of a recording apparatus in which an ink cartridge of the  
20 invention is used;

Figs. 2A and 2B are perspective views respectively showing the front structure and the back structure of the ink cartridge of the invention;

Figs. 3A and 3B are respectively a plan view and  
25 a sectional view, showing one embodiment of an antenna

attached onto the ink cartridge;

Fig. 4 is a perspective view showing a state where the ink cartridge has been attached onto a carriage;

Fig. 5 is a block diagram showing a system by which the ink cartridge executes communication with a recording apparatus body;

Fig. 6 is a plan view showing another embodiment of the antenna portion which can be applied to the ink cartridge of the invention;

Fig. 7 is a perspective view showing another embodiment of the ink cartridge of the invention; and

Figs. 8A, 8B, and 8C are respectively a perspective view of an ink cartridge in another embodiment of the invention, and diagrams showing sectional structure of an antenna portion in the ink cartridge.

#### DESCRIPTION OF THE PREFERRED EMBODIMENTS

The invention will be described below in detail with reference to shown embodiments.

Fig. 1 shows one embodiment of an ink jet recording apparatus suitable to use an ink cartridge of the invention, in which a black ink cartridge 3 for supplying ink to the recording head 1 and plural color ink cartridges 4 are removably attached on an upper surface of a carriage 2 including an ink jet recording head on its lower surface.

Next, one embodiment of the above ink cartridge shown in Figs. 2A and 2B will be described, taking the color ink cartridge 4 as an example. Except that the black ink cartridge 3 is different from the color ink cartridge 4 in thickness, the black ink cartridge 3 has the same structure as the structure of the color ink cartridge 4.

In the color ink cartridge 4, a container for storing ink therein comprises a flat container body 5 which has an opening portion on one side, a nearly rectangular shape and a wall surface 5a at the upper portion of the container, which inclines from an ink supply port 7 side; and a lid member 6 which seals the opening portion of the container body 5.

In the container, on a wall surface intersecting a wall surface on which the ink supply port 7 is formed, at least one lever for supporting removal of the ink cartridge from the recording apparatus is provided. In this embodiment, two levers 20 and 21 are provided respectively on the wall surfaces opposite to each other.

On the upper surface 5a of the container body 5, a memory unit is provided, which includes an antenna portion 10 for receiving carrier waves for electric power from the recording apparatus 30 and transmitting data described later to the recording apparatus.



The antenna portion 10, as shown in Figs. 3A and 3B, is formed on the upper surface 5a (the surface opposed to the wall on which the ink supply port 7 is formed) of the container body 5 constituting the ink cartridge, that is, at the upper portion of the container body 5 in an attachment state of the ink cartridge. The antenna portion 10 has a width that is narrower a little than a width of the upper surface 5a, that is, a width W that does not protrude to the lid side. Further, the antenna portion 10 includes a band-shaped electric insulation film 11 covering the upper surface 5a in the longitudinal direction as a base body, an adhesive layer 12 on a back surface, and a conductive layer 13 of rectangular and at least one spiral pattern on a surface. Further, according to necessity, a protective film 14 is formed on the surface of the conductive layer 13.

Of lead lines 13a and 13b of the conductive layer 13 of spiral pattern, the lead line 13a striding over the circumference pattern portion is connected through an insulation layer to an IC 15 mounted on the base body.

In the area in which the conductive layer 13 of the spiral pattern is not formed, of the thus constructed antenna portion 10, the IC 15 having a semi-conductive memory element such as an EEPROM (electrically erasable programmable read-only memory) is mounted and connected

to the conductive layer 13 of the antenna portion 10 to constitute the memory unit (non-contact IC tag). This memory unit is stuck through the adhesive layer 12 onto the upper surface 5a of the container body 5. The antenna  
5 portion 10, particularly the conductive layer 13 of rectangular and at least one spiral pattern is so constituted as to occupy at least 70% of the area of the stuck surface of the container. The size of the conductive layer 13 is selected so as to obtain increase  
10 of efficiency of transmission and reception of radio signals, and sufficient adhesive strength.

According to this embodiment, in the state where the ink cartridge is attached on the carriage 2, as shown in Fig. 4, the antenna portion 10 is exposed from the  
15 opening of the carriage 2. Therefore, even if the carriage is made of the conductive material, without receiving shield, an antenna on the recording apparatus side is arranged in an upper lid 9 (Fig. 1) of a case constituting the recording apparatus, whereby sure  
20 communication can be performed with transmission power as small as possible.

Further, this cartridge is removed with the levers  
20 and 21 formed at the container body 5 gripped. Therefore, due to the erroneous touch onto the antenna  
25 portion 10, external force in the peeling-off direction

is not applied onto the antenna portion 10.

Further, since the antenna portion 10 is arranged on the upper surface 5a (surface opposed to the surface on which the ink supply port 7 is formed) of the cartridge, an accident such as a short circuit due to the ink that has leaked from the ink supply port 7 can be prevented.

The above embodiment has been described, taking the color ink cartridge 4 as an example. However, since the black ink cartridge 3 is larger in width than the color ink cartridge 4, the same antenna portion 10 can be provided for the black ink cartridge 3 as shown in Fig. 4. Namely, the antenna portion of the same specification can be applied to the containers which are different in the ink amount.

Fig. 5 shows one embodiment of a system which executes communication with the recording apparatus. When the carriage 2 moves to the predetermined position, a not-shown control section of the recording apparatus 30 detects this movement and outputs carrier waves from an antenna portion 31. The carrier wave received by the antenna portion 10 of the ink cartridge 4 inputs through a branching section into only an electric power generating section 41, and is converted into DC electric power to become working electric power. Its working electric power charges a not-shown storage unit.

When the time necessary to charge the storage unit has passed, the recording apparatus stops the transmission of the carrier waves. When a control section 42 and a sensor 18 receive supply of power from the storage unit, an ink amount detecting section 43  
5 calculates the amount of the residual ink on the basis of signals from the sensor 18, and data of the ink stored in the memory section (EEPROM) 8 is read out. These data are transmitted by a high-frequency transmit-receive  
10 section 44 as a high-frequency signal from the antenna portion 10 to the recording apparatus 30.

As described above, by repeating the above operation at the predetermined period, the communication between the ink cartridge 4 and the recording apparatus  
15 30 can be performed.

Fig. 6 shows another embodiment of the memory unit having the antenna portion 10, in which an expansion part 11a is formed at one end portion of an electrically insulating film 11, and a liquid surface sensor 18 is  
20 fixed to this expansion part 11a. In the figure, the same members as those in the former embodiment or the materials corresponding to those in the former embodiment are denoted by the same reference numerals.

According to this embodiment, by sticking the  
25 memory unit onto the container constituting the ink

cartridge, the liquid surface sensor 18 can be attached to the ink cartridge. Further, since the liquid surface sensor 18 is mounted on the expansion part 11a, by bending the region of this expansion part, the liquid surface  
5 sensor 18 can be arranged on the wall surface different from the wall surface on which the antenna portion 10 of the memory unit is fixed.

In the above embodiments, the antenna portion 10 is exposed. However, as shown in Fig. 7, in case that  
10 a protective cover material 16 to which an adhesive is applied is stuck on at least a surface of the antenna portion 10, and preferably so as to cover side surfaces of the cartridge, it is possible to prevent break of the antenna portion 10 due to a rub with another member caused  
15 in transportation of products.

Further, as shown in Fig. 8A, a recess portion 17 having such a depth that the antenna portion 10 can be housed may be formed in one surface of the container body  
5 constituting the ink cartridge 4, for example, in the upper surface 5a thereby to house the antenna portion 10 in this recess portion 17. In this case, it is preferable that the IC 15 mounted on the antenna portion 10 can be also housed in the recess portion.

According to this embodiment, as shown in Fig. 8B,  
25 since the upper surface of the antenna portion 10 is

located lower than the surface of the container body 5, the rub can be surely prevented. In order to obtain sureness, opening of the recess portion 17 may be sealed by the protective cover material 16.

5           Further, as shown in Fig. 8C, in case that a depth  $d_2$  of the recess portion 17 is made larger than a thickness  $d_1$  of the antenna portion 10, contact with the adhesive layer comprising an adhesive tape, of the protective cover material 16 is prevented, whereby the antenna  
10   portion can be readily reused.